

**Remarks**

In the foregoing claim amendments, claims 1, 3, 4, 6, 15, 16, 18, 19, 21 and 30 have been amended, and claims 31-45 canceled. Now pending in the application are claims 1-30, of which claims 1, 4, 15, 16, 19 and 30 are independent. The following comments address all stated

- 5 grounds for rejection, and the Applicant respectfully submits that the presently pending claims, as identified above, are now in a condition for allowance.

**Oath and Declaration**

The Examiner notes in the Office Action that the Oath/Declaration is missing. Applicant submits that the Combined Declaration and Power of Attorney was filed on January 14, 2002 in response to the Notice to File Missing Parts of Application. A copy of the Combined Declaration and Power of Attorney is attached herewith. Also enclosed is a Power of Attorney subsequently giving Lahive & Cockfield, LLP the power to prosecute this application.

**Specification**

The Examiner notes in the Office Action that the Abstract does not contain sufficient description of the technical disclosure of the invention. In the foregoing amendments to the Specification, Applicant has canceled the previous Abstract and added new Abstract to provide sufficient description of the technical disclosure of the invention. In light of the amendments to the Specification, Applicant submits that the new Specification addresses all of the issues raised by the Examiner.

20 **Claim Objections**

Claims 16-30 are objected to because of some informalities. In the foregoing claim amendments, Applicant has amended claims 16 and 30 to address the informalities. In light of the claim amendments, Applicant submits that claims 16-30 are in condition for allowance, and requests the Examiner withdraw the objection to claims 16-30.

25 **Claim Rejections - 35 U.S.C. §112, first paragraph**

Claims 31-45 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. In the foregoing claim amendments, Applicant has canceled

claims 31-45. In light of the claim amendments, Applicant requests the Examiner withdraw the rejection of claims 31-45 under 35 U.S.C. §112, first paragraph.

Claim Rejections - 35 U.S.C. §112, second paragraph

Claims 1-14, 16-29 and 31-44 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. In the foregoing claim amendments, Applicant has amended claims 1 and 16 to address all of the issues, such as antecedent basis issues, raised by the Examiner in the Office Action. In light of the claim amendments, Applicant submits that claims 1-14 and 16-29 are in condition for allowance and requests the Examiner withdraw the rejection of claims 1-14, 16-29 and 31-44 under 35 U.S.C. §112, second paragraph.

10 Claim Rejections - 35 U.S.C. §101

Claims 1-15 are rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter. The Examiner notes in the Office Action that claims 1-15 are non-statutory because they are directed to a method without recitation of a computer or computer-readable medium employing the method. In the foregoing claim amendment, Applicant has amended claims 1, 4 and 15 to recite an electronic device that employs the method. In light of the claim amendments, Applicant requests the Examiner withdraw the rejection of claims 1-15 under 35 U.S.C. §101.

Claim Rejections - 35 U.S.C. §102

Claims 1-45 are rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,502,110 (“Houldsworth”). Applicant respectfully traverses the rejection for the following reasons.

The claimed invention in independent claims 1, 4 and 15 determines a first value indicative of a number of references to the candidate object that are not references from other objects in the object-oriented environment (in claim 1), a second value indicative of a number of references to the candidate object from other objects in the object-oriented environment, and a third value indicative of a number of cyclic paths including the candidate object. The present invention in claim 1 controls the disposition of a candidate object *on the basis of the first value, the second value and the third value*. The present invention in claims 4 and 15 controls the disposition of the candidate object *on the basis*

*of a predetermined relationship between the second value and the third value.* Claims 16, 19 and 30 are medium claims that parallel claims 1, 4 and 15, respectively.

The Houldsworth relates to a method and apparatus for reclaiming memory space allocated to data structure.

5           Claims 1-3 and 16-18

Applicant has amended independent claims 1 and 16 to incorporate the features recited in claims 4 and 19, respectively. No new matter has been introduced. Applicant submits that the Houldsworth fails to disclose that the disposition of the candidate object is controlled *on the basis of the first value, the second value and the third value*, as recited in claims 1 and 16.

10          Houldsworth discloses general garbage collection reclamation techniques that involve marking data objects reachable by other objects or from external locations. (See, Houldsworth, Column 1, lines 28-35). Houldsworth also discloses a combination of a first (mark-sweep) system and a second (reference-sweep) system in which cycles of the first system are interleaved with cycles of the second system. Houldsworth discloses that the first system identifies objects to  
15 which *no references are made by other objects* and the second system determines objects that are not descendants of root objects. Houldsworth reclaims the memory allocated to the objects identified and determined by the first and second systems. (See, Houldsworth, Column 2, lines 28-40).

In comparison, the claimed invention controls the disposition of a candidate object  
20 on the basis of the first value, the second value and the third value. The first and second values are indicative of the number of internal references that are from the objects in the object-oriented environment, and the number of external references that are not from the objects in the object-oriented environment, respectively. That is, the claimed invention controls the disposition of the candidate object on the basis of *both the number of internal references*  
25 and the number of external references to the candidate object. Houldsworth appears to disclose that the first system reclaims the memory allocated to objects if no *internal references* are made to the objects. (See, Houldsworth, Column 2, lines 34-35). Houldsworth, however, does not disclose that the disposition of a candidate object is controlled on the basis of both the number of internal references and the number of external references to the candidate object.

Additionally, the claimed invention controls the disposition of a candidate object on the basis of a third value as well as the numbers of internal and external references. The third value is indicative of the number of cyclic paths including the candidate object. That is, the claimed invention controls the disposition of the candidate object on the basis of the

5 number of the internal and external references to the candidate object, and the number of cyclic paths including the candidate object. Houldsworth does not disclose that the disposition of a candidate object is controlled *on the basis of all of three values* recited in the claimed invention. Houldsworth discloses at most that the first and second systems reclaim the memory allocated to objects based on the internal references to the objects and whether the

10 objects are descendants of root objects.

In light of the aforementioned arguments, Applicant respectfully submits that the Houldsworth fails to disclose each and every element of independent claims 1 and 16. Applicant therefore requests the Examiner withdraw the rejection of claims 1-3 and 16-18 under 35 U.S.C. §102(e), and pass the claims to allowance.

15        Claims 4-15 and 19-30

Applicant has amended claims 4 and 19 in independent form. No new matter has been introduced. Applicant submits that the Houldsworth fails to disclose that the disposition of the candidate object is controlled *on the basis of the predetermined relationship between the second value (the number of internal references in claims 15 and 30) and the third value (the number of cyclic paths in claims 15 and 30)*, as recited in claims 4, 15, 19 and 30. The second value is indicative of the number of internal references that are made by other objects in the object-oriented environment in claims 4 and 19. The third value is indicative of the number of cyclic paths in claims 4 and 19.

Houldsworth discloses a combination of a first (mark-sweep) system and a second (reference-sweep) system where cycles of the first system are interleaved with cycles of the second system. In Houldsworth, the first system may identify objects to which no internal references are made by other objects and the second system determines objects that are not descendants of root objects. Houldsworth reclaims the memory allocated to the objects identified and determined by the first and second systems. (See, Houldsworth, Column 2, lines 28-40).

25        Houldsworth also discloses that the first system may reclaim the memory allocated to a group of

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objects that reference each other but are not referenced by root objects. (See, Houldsworth, Column 2, lines 41-46).

In comparison, the claimed invention controls the disposition of the candidate object on the basis of *the predetermined relationship between the number of the internal references to the candidate object and the number of cyclic paths including the candidate object.*

For example, in an illustrative embodiment described with reference to Figures 4A and 4B of the pending application, the candidate object is destroyed if the number of the internal references to the candidate object is equal to the number of cyclic paths including the candidate object. Houldsworth just discloses that the first system can reclaim the memory allocated to a group of objects that reference each other but are not referenced by root objects. Houldsworth does not disclose the relationship between the number of the internal references to the candidate object and the number of cyclic paths including the candidate object for destroying the candidate object. Houldsworth therefore does not disclose that the disposition of a candidate object is controlled on the basis of the relationship between the number of the internal references to the candidate object and the number of cyclic paths including the candidate object, as recited in the claimed invention.

The Examiner indicates in the Office Action that this feature of the claimed invention is disclosed at column 6, lines 41-47 of the Houldsworth reference. Applicant respectfully disagrees with the Examiner's position. The Houldsworth reference discloses at column 6, lines 41-47 that the reference counting can be performed during either or both of the mark sweep cycle (the first system) and the reference sweep cycle (the second system). The Houldsworth reference, however, does not disclose the relationship between the number of the internal references to the candidate object and the number of cyclic paths including the candidate object for destroying the candidate object. The Houldsworth reference only discloses that the reference counting can be performed during either or both of the mark sweep cycle and the reference sweep cycle. This disclosure of the Houldsworth reference does not anticipate that the disposition of a candidate object is controlled on the basis of the relationship the number of the internal references to the candidate object is equal to the number of cyclic paths including the candidate object, as recited in the claimed invention.

Additionally, the Examiner also indicates in the Office Action the cycles of the first system or the second system disclosed in Houldsworth correspond to the cyclic paths of the claimed invention. Applicant respectfully disagrees with the Examiner's position. The cyclic paths of the claimed invention are the paths including the candidate object the disposition of which is controlled, as recited in claims 4, 15, 19 and 30. The cycles of the first or second system in Houldsworth are program or process cycles for reclaiming memory space allocated to data objects. The cycles of the first or the second system in Houldsworth can not correspond to the cyclic paths of the claimed invention because the cycles of the first or second system in Houldsworth do not include the candidate object the disposition of which is controlled.

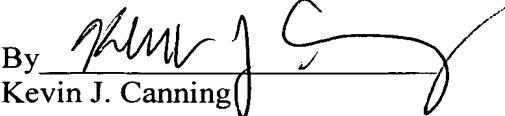
In light of the aforementioned arguments, Applicant respectfully submits that the Houldsworth fails to disclose each and every element of independent claims 4, 15, 19 and 30. Applicant therefore requests the Examiner withdraw the rejection of claims 4-15 and 19-30 under 35 U.S.C. §102(e), and pass the claims to allowance.

**CONCLUSION**

In view of the above, each of the presently pending claims in this application is believed to be in condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue. If, however, the Examiner considers that further obstacles to allowance 5 of these claims persist, we invite a telephone call to Applicant's representative.

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Respectfully submitted,

By   
Kevin J. Canning  
Registration No. 35,470  
LAHIVE & COCKFIELD, LLP  
28 State Street  
Boston, Massachusetts 02109  
(617) 227-7400  
(617) 742-4214 (Fax)  
Attorney for Applicant